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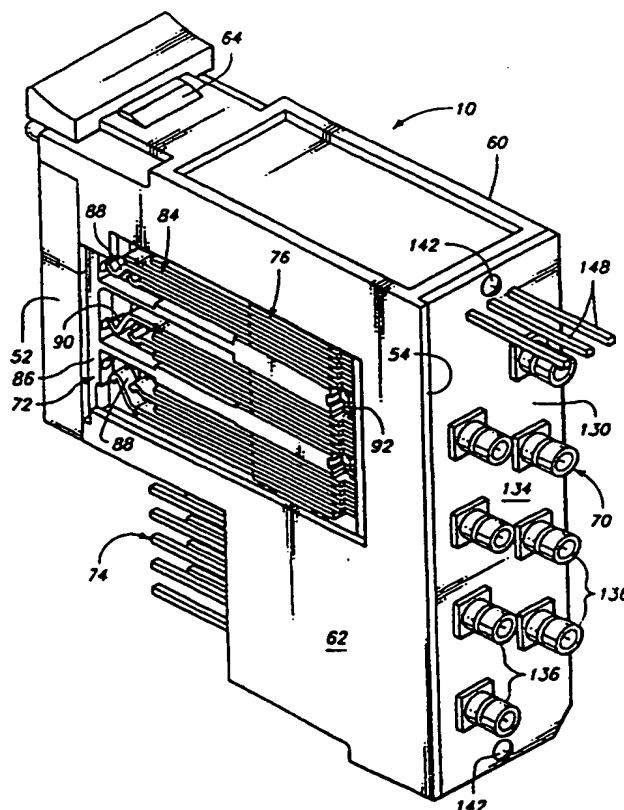
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(54) Title: TELECOMMUNICATION JACK MODULE WITH INTERCHANGEABLE BACK PLANE

## (57) Abstract

A universal front cross-connect mini-bantam jack module (10) for mounting to a telecommunication termination panel (12). The module has a rear input/output connector termination field (70), a front access jack field (72) and a front access cross-connect field (74). The front access jack field (72) has a plurality of jacks (76) with jack switches (84) for terminating cross-connect communication when a mini-bantam plug is inserted into a corresponding jack (76). Each jack switch (84) has leaf springs elements (88) that are mounted on an internal jack printed circuit board (110). The module (10) has an interchangeable backplane printed circuit board (130) with input/output termination connectors (136) secured to a rear side thereof. An interconnecting connector (140) is mounted on a front side of the printed circuit board (130) for connecting to complementary connectors (120) on a rear face of the jack printed circuit board (110).



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## DESCRIPTION

### TELECOMMUNICATION JACK MODULE WITH INTERCHANGEABLE BACK PLANE.

#### Technical Field

5 This invention is concerned with telecommunication mini-bantam jack cross-connect modules for terminating, patching, monitoring and/or front cross-connecting low frequency telecommunication circuits at a termination panel.

#### Background Art

One of the principal objectives and advantages of this invention is to  
10 provide a universal front cross-connect mini-bantam jack module having interchangeable backplane printed circuit boards for enabling the user to use the same basis module for a wide variety of low-frequency termination cable connectors.

#### Brief Description of the Drawings

15 Preferred embodiments of the invention are described below with reference to the accompanying drawings, which are briefly described below.

Fig. 1 is an front isometric view of a telecommunication panel containing a mini-bantam jack module of a preferred embodiment.

Fig. 2 is a vertical cross-sectional view taken along line 2-2 in Fig. 1.

20 Fig. 3 is a front isometric view of the mini-bantam jack module illustrated in Figs. 1 and 2 showing a front access mini-bantam jack field and a front cross-connect field.

Fig. 4 is a rear isometric view of the mini-bantam jack module illustrated in Fig. 3 showing an interchangeable coaxial input/output backplane.

25 Fig. 5 is a elevational side view of the mini-bantam jack module illustrated in Figs. 3 and 4.

Fig. 6 is a horizontal cross-sectional view taken along line 6-6 in Fig. 5 illustrating, in plan view a backplane printed circuit board connected to a jack terminal printed circuit board.

30 Fig. 7 is vertical cross-sectional view taken along line 7-7 in Fig. 5 illustrating a rear surface of the jack terminal printed circuit board.

Fig. 8 is a vertical cross-sectional view taken along line 8-8 in Fig. 5 illustrating a front facing surface of a backplane printed circuit board.

Fig. 9 is an electrical schematic of the of the module shown in Figs. 3  
35 and 4.

Fig. 10 is a rear view of an alternate module backplane having a printed circuit board with Insulation Displacement Connectors (IDC) mounted thereon.

Fig. 11 is side view of the alternate module backplane illustrated in Fig. 10.

5 Fig. 12 is an electrical schematic of a module having the alternate backplane shown in Fig. 10.

Fig. 13 is a rear view of an alternate module backplane having a printed circuit board with wire-wrap pin connectors mounted thereon.

10 Fig. 14 is a side view of the alternate module backplane shown in Fig. 13. and

Fig. 15 is an electrical schematic of a module having the alternate backplane shown in Fig. 13.

#### **Best Modes for Carrying Out the Invention and Disclosure of Invention**

A preferred embodiment of this invention is represented by the  
15 telecommunication mini-bantam jack module generally designated with the numeral 10 that is illustrated in Figs. 3 and 4. A module 10 having four mini-bantam jack assemblies 76 is the basic building block. Multiple modules 10 are intended to be inserted into a telecommunication equipment termination panel 12. Preferably fourteen modules 10 are insertable in a 19 inch width panel 12. Preferably sixteen modules 10 are insertable in a 23 inch width panel 12.  
20

The panel 12 has an elongated panel chassis 14 defined by a top wall 16, a bottom wall 18, side walls 20, 24, back wall 24 and front wall 28. The back wall 24 has a back wall opening 26. The front wall 28 has a front opening 30 through which each of the modules 10 is inserted. The panel  
25 chassis 14 has a hinged transparent front door 32 for enclosing part of the front opening 30 after the modules 10 are inserted. Additionally the panel chassis 14 has a rear cable support 34 projecting outward from the back wall 24 for facilitating the support and termination of telecommunication equipment cables (not shown).

30 The top and bottom walls 16, 18 have respective locking means 38 and 40 for releasably locking the modules to panel 12 once the modules are fully inserted. The lower locking means 40 has a detent 42 and an aperture 44 formed therein for releasably securing a module 10 to the chassis along the bottom wall 18. The upper locking means 38 has a front wall retaining ledge  
35 for securing a module along the top wall 16.

Each module 10 has a general housing 50 that generally extends from a front face or front panel 52 to a rear panel or backplane 54. The housing 50 includes a top wall 56, a bottom wall 58, and side walls 60, 62. The top wall 56 includes a top releasable latch 64 (Fig. 2 and 3) that cooperates with the front wall retaining ledge to releasably secure the module 10 to the panel chassis 14. Likewise the bottom wall 58 has a lower latch 66 (Figs. 1 and 2) that cooperates with one of the apertures 44 to releasably secure the module to the bottom wall 18.

The module 10 has a rear input/output field 70 (Fig. 4) at the backplane 54 having input/output connectors 138 for semi-permanently connecting to ends of the cables from the telecommunication equipments. The module 10 has a front access bantam jack field 72 for enabling monitoring and temporarily patching to or from the telecommunication equipments. The module 10 further importantly has a front cross-connect field 74 for enabling the telecommunication equipments to terminate at the rear input/output field 70 to be cross-connected at the front of the module.

The front access mini-bantam jack field 72 includes, one or more, preferably four mini-bantam jack assemblies 76. Each jack assembly 76 has a front access mini-bantam jack plug IN aperture 78, a front access mini-bantam jack plug OUT aperture 80 and a front access mini-bantam jack plug MONITOR aperture 82. Each jack assembly 76 has at least two jack switches 84 supported on a jack frame 86. Each of the jack switches 84 has contact spring elements 88 with front ends 90 that project forward toward the apertures 78, 80, and 82 and rear terminal ends 92 that extend rearward terminating in an internal jack printed circuit board 110.

The front access cross-connect field 72 preferably includes a plurality of connectors in the form of wire wrap pins 100. The pins 100 have front ends 102 that project forward of the front face 52 to receive interconnecting wire wrap conductors. The pins 100 have rear ends 104 that extend through a lower portion of the front face 52 terminating in the internal jack printed circuit board 110.

The internal jack printed circuit board 110 is mounted in the housing 50 between the front face 52 and the backplane 54. The internal printed circuit board 110 is mounted transverse to the jack assemblies 76 and spaced forward and substantially parallel with the backplane 54.

The internal printed circuit board 110 has a front face 112 that faces forward and a rear face 114 (Fig. 7) that faces the backplane 54. The internal printed circuit board 110 is secured to the housing by fasteners 116. Importantly the internal printed circuit board 110 receives and supports the rear ends 92 and 104. The board 110 has printed circuits 118 that electrically interconnect the components. For example, the ends 92 of the spring elements 88 and the ends 104 of the wire wrap pins 110 extend through the board 110 and are soldered to the circuits 118 on the rear face 114 as shown in Fig. 7 and as illustrated in electrical schematic form in Fig. 9.

The internal printed circuit board 110 has a printed circuit board terminal connector 120 mounted on the rear face for electrically interconnecting the front jack field 72 and the front cross-connect field 74 with the rear input/output field 70. The printed circuit board terminal connector 120 includes a pin block 122 having a plurality of elongated small-diameter interconnecting pins 124 with mounting ends 126 extending through the printed circuit board 110 and soldered to the front face 112. The pins have projecting ends 128 that project outward toward the backplane 54.

Importantly, the universal module 10 has interchangeable backplane printed circuit boards 130 for enabling the universal module 10 to be connected to the telecommunication equipments at the backplane independently of the type of connectors that are on the ends of the cables. The interchangeable backplane printed circuit boards enable the universal module 10 to be connected to cables having coaxial BNC, TNC, BT43 or Type 43 female connectors. Additionally the interchangeable backplane printed circuit boards 130 enable the universal module to be connected to twisted pair cables requiring wire pin connectors or insulation displacement connectors.

Each backplane printed circuit board 130 has a front facing surface 132 (Fig. 8) and a rear facing surface 134 (Fig. 4). A plurality of input/output termination connectors 136 are permanently or semi-permanently mounted to the printed circuit board and extending outward from the rear facing surface for connecting to complementary connectors on the end of the termination cables. Each board 130 has a plurality of printed circuits 138 interconnecting the input/output termination connectors 136 with a printed circuit board connector 140.

The printed circuit board connector 140 is mounted on the front facing surface 132 for receiving the projecting ends 128 of the interconnecting pins 124

from the jack printed circuit board 110. To enable the backplane printed circuit boards to be interchangeable, a releasable fastener 142 is provided to releasably secure a chosen backplane board 130 to the housing 50. Preferably the fastener 142 are screws (Fig. 4).

5 Balun transformers 144 are provided as part of the printed circuits 138, as illustrated in the electrical schematic Fig. 9, to interchangeable boards 130 that have coaxial connectors 136. The electrical circuit shown in Fig. 9 is applicable for coaxial connectors 136 such as BNC, TNC, BT43 and Type 43. The coaxial connectors shown in Fig. 4 are "BT 43" connectors which are  
10 common in many of the European countries. "BNC" and "TNC" coaxial connectors are quite common in North America.

The interchangeable backplane printed circuit board 130 shown in Figs. 10-12 has insulated displacement connectors (IDC) 152. The interchangeable backplane printed circuit board 130 shown in Figs. 13-15 has  
15 twisted pair wire wrap connectors 162. Preferably each of the backplane boards 130 has LED terminals 148 for providing power for LED's mounted on the front of the modules 10.

The above described embodiment enable the manufacturer to construct a single universal mini-bantam jack front cross-connect module that is capable of  
20 servicing a wide variety of low frequency telecommunication equipments, by mounting the compatible backplane printed circuit board having the complementary input/output termination connectors at the rear of the module. Should the customer have a variety if systems, then the customer merely needs to inventory the universal module with a variety of backplane boards 130. This  
25 saves the customer from having to inventory a multitude of single connector type modules. Furthermore it dramatically reduces the number of instances in which the telecommunication worker has the wrong module for the intended task. The module 10 is particularly important for telephone companies that have both coaxial and twist pair cables for low frequency equipment.

CLAIMS

1. A telecommunication bantam jack front cross-connect module for mounting in a telecommunication termination panel, comprising:

a module housing extending between a front and a backplane;

5 a rear input/output field at the backplane of the housing for terminating at least two pieces of telecommunication equipment to communicate digital signals between the two pieces of telecommunication equipment;

a front jack field at the front of the housing;

a front cross-connect field at the front of the housing to enable the two  
10 pieces of telecommunication equipment to be cross-connected;

an internal jack printed circuit board mounted in the housing intermediate the front and backplane having a front face spaced the housing front and a rear face spaced from the housing backplane;

said jack field having a plurality of mini-bantam jacks with jack switch  
15 assemblies mounted side-by-side in the housing for electrically interrupting cross-connect communication between the two pieces of telecommunication equipment and providing electrical front access to the digital signals when mini-bantam plugs are inserted into the jacks;

said jack switch assemblies have spring terminals mounted to the internal  
20 jack printed circuit board and extending forward from the front face toward the front of the housing;

said internal jack printed circuit board having a printed circuit board connector mounted to the rear face that is electrically connected by printed  
25 circuits to the spring terminals of the jack switch assemblies and to the cross-connect field;

said backplane comprising an interchangeable backplane printed circuit board removably mounted to the housing spaced from the internal jack printed circuit board and having a forward facing surface and a rearward facing surface;

said input/output field comprising a plurality of input connectors and  
30 output connectors mounted to the rear facing surface of the backplane printed circuit board for connecting to the telecommunication equipments to terminate the equipments;

said backplane printed circuit board having a printed circuit board connector mounted on the forward facing surface with printed circuits electrically  
35 connecting the backplane printed circuit board connector with the input connectors and output connectors;



interconnector means extending between the backplane printed circuit board connector and the internal jack printed circuit board connector to electrically interconnect the input and output connectors of the rear input/output field with the jack field and the cross-connect field.

5

2. The telecommunication bantam jack front cross-connect module as defined in claim 1 wherein the interchangeable backplane printed circuit board has coaxial input and output connectors mounted to the rear facing surface.

10

3. The telecommunication bantam jack front cross-connect module as defined in claim 2 wherein the coaxial input and output connectors are BNC coaxial connectors.

15

4. The telecommunication bantam jack front cross-connect module as defined in claim 2 wherein the coaxial input and output connectors are TNC coaxial connectors.

20

5. The telecommunication bantam jack front cross-connect module as defined in claim 2 wherein the coaxial input and output connectors are BT43 coaxial connectors.

25

6. The telecommunication bantam jack front cross-connect module as defined in claim 2 wherein the coaxial input and output connectors are Type 43 coaxial connectors.

30

7. The telecommunication bantam jack front cross-connect module as defined in claim 2 wherein the interchangeable backplane printed circuit board has a plurality of transformer baluns mounted on the forward facing surface and electrically connected with corresponding coaxial connectors through the printed circuits.

35

8. The telecommunication bantam jack front cross-connect module as defined in claim 1 wherein the interchangeable backplane printed circuit board has twisted pair input and output connectors mounted to the rear facing surface.

9. The telecommunication bantam jack front cross-connect module as defined in claim 7 wherein the twisted pair input and output connectors are wire wrap pin connectors.

5 10. The telecommunication bantam jack front cross-connect module as defined in claim 7 wherein the twisted pair input and output connectors are insulation displacement connectors (IDC).

10 11. The telecommunication bantam jack front cross-connect module as defined in claim 1 wherein the interchangeable backplane printed circuit board has input/output connectors selected from a group consisting of BNC coaxial connectors, TNC coaxial connectors, Type 43 coaxial connectors, BT43 coaxial connectors, wire wrap pin connectors and insulation displacement connectors.

15 12. The telecommunication bantam jack front cross-connect module as defined in claim 1 wherein both the backplane printed circuit board and the internal jack printed circuit board are parallel with each other transverse to the mini-bantam jacks.

20 13. The telecommunication bantam jack front cross-connect module as defined in claim 1 wherein the housing included means for releasably securing the interchangeable backplane printed circuit board to the housing.

25 14. The telecommunication bantam jack front cross-connect module as defined in claim 1 wherein the interconnector means includes elongated conductive pins that have one end affixed to one of the printed circuit board and the other end adapted to be receive within the printed circuit board connector of the other printed circuit board when the backplane printed circuit board is releasably mounted to the housing to electrically interconnect the input and output connectors of the rear input/output field with the jack field and the cross-connect field.

30 15. The telecommunication bantam jack front cross-connect module as defined in claim 14 wherein the one end of the elongated conductive pins are affixed to the internal jack printed circuit board and the other ends are slidable into the backplane printed circuit board connector.

16. A telecommunication bantam jack front cross-connect module for mounting in a telecommunication termination panel, comprising:

a module housing extending between a front and a backplane;

a rear input/output field at the backplane of the housing for terminating  
5 at least two pieces of telecommunication equipment to communicate digital signals between the two pieces of telecommunication equipment;

a front jack field at the front of the housing;

a front cross-connect field at the front of the housing to enable the two pieces of telecommunication equipment to be cross-connected;

10 an internal jack printed circuit board mounted in the housing intermediate the front and backplane having a front face spaced the housing front and a rear face spaced from the housing backplane;

said jack field having a plurality of mini-bantam jacks with jack switch assemblies mounted side-by-side in the housing for electrically interrupting cross-  
15 connect communication between the two pieces of telecommunication equipment and providing electrical front access to the digital signals when mini-bantam plugs are inserted into the jacks;

said jack switch assemblies have spring terminals mounted to the internal jack printed circuit board and extending forward from the front face toward the  
20 front of the housing;

said internal jack printed circuit board having a printed circuit board connector mounted to the rear face that is electrically connected by printed circuits to the spring terminals of the jack switch assemblies and to the cross-connect field;

25 said backplane comprising an interchangeable backplane printed circuit board removably mounted to the housing spaced from the internal jack printed circuit board and having a forward facing surface and a rearward facing surface;

said input/output field comprising a plurality of input connectors and output connectors mounted to the rear facing surface of the backplane printed  
30 circuit board for connecting to the telecommunication equipments to terminate the equipments;

said backplane printed circuit board having a printed circuit board connector mounted on the forward facing surface with printed circuits electrically connecting the backplane printed circuit board connector with the input  
35 connectors and output connectors;

interconnector means extending between the backplane printed circuit board connector and the internal jack printed circuit board connector to electrically interconnect the input and output connectors of the rear input/output field with the jack field and the cross-connect field; and

5 wherein the interchangeable backplane printed circuit board has input/output connectors selected from a group consisting of BNC coaxial connectors, TNC coaxial connectors, Type 43 coaxial connectors, BT43 coaxial connectors, wire wrap pin connectors and insulation displacement connectors.

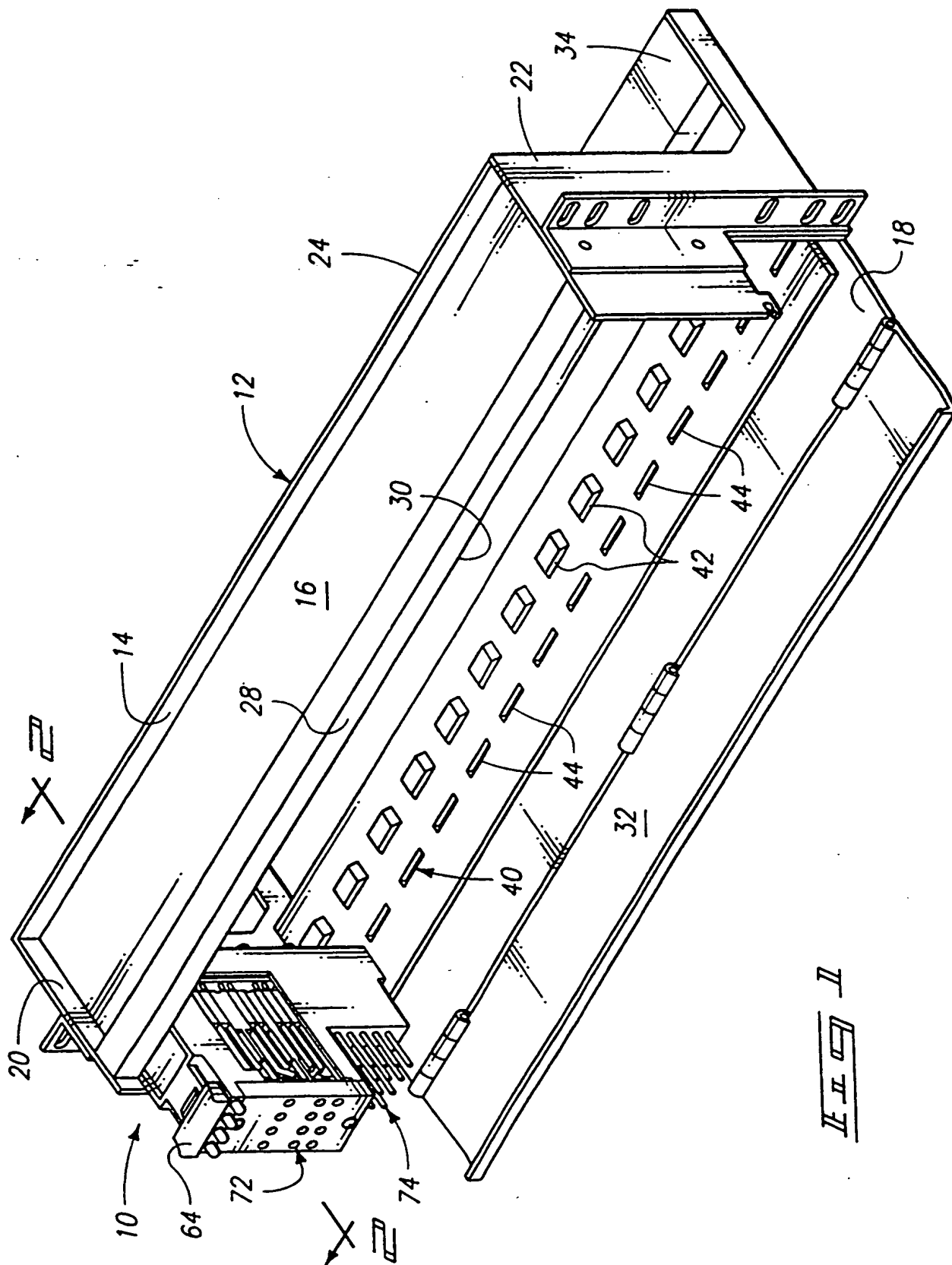
10 17. The telecommunication bantam jack front cross-connect module as defined in claim 16 wherein both the backplane printed circuit board and the internal jack printed circuit board are parallel with each other transverse to the mini-bantam jacks.

15 18. The telecommunication bantam jack front cross-connect module as defined in claim 16 wherein the housing included means for releasably securing the interchangeable backplane printed circuit board to the housing.

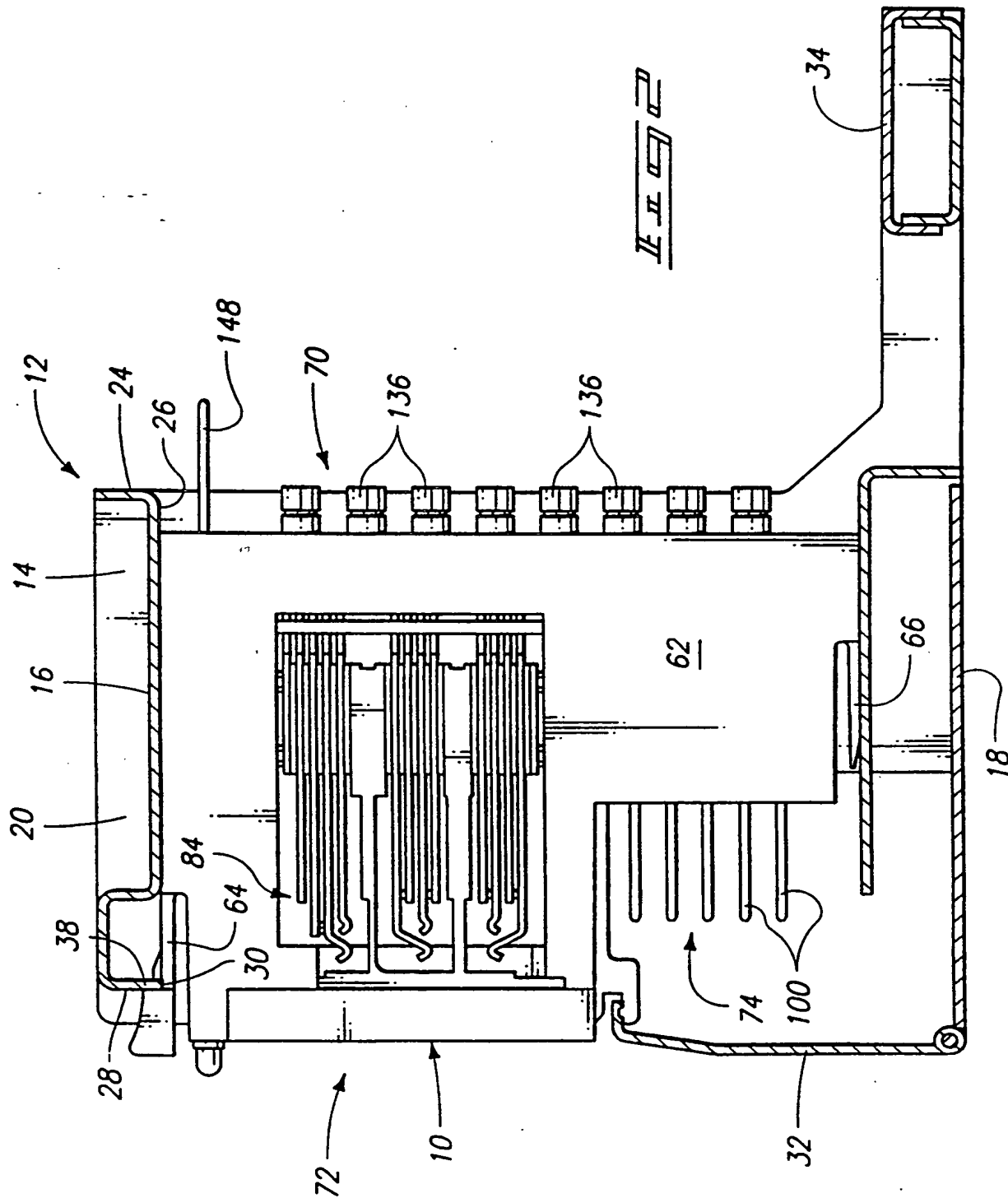
20 19. The telecommunication bantam jack front cross-connect module as defined in claim 16 wherein the interconnector means includes elongated conductive pins that have one end affixed to one of the printed circuit board and the other end adapted to be receive within the printed circuit board connector of the other printed circuit board when the backplane printed circuit board is releasably mounted to the housing to electrically interconnect the input  
25 and output connectors of the rear input/output field with the jack field and the cross-connect field.

30 20. The telecommunication bantam jack front cross-connect module as defined in claim 19 wherein the one end of the elongated conductive pins are affixed to the internal jack printed circuit board and the other ends are slidable into the backplane printed circuit board connector.

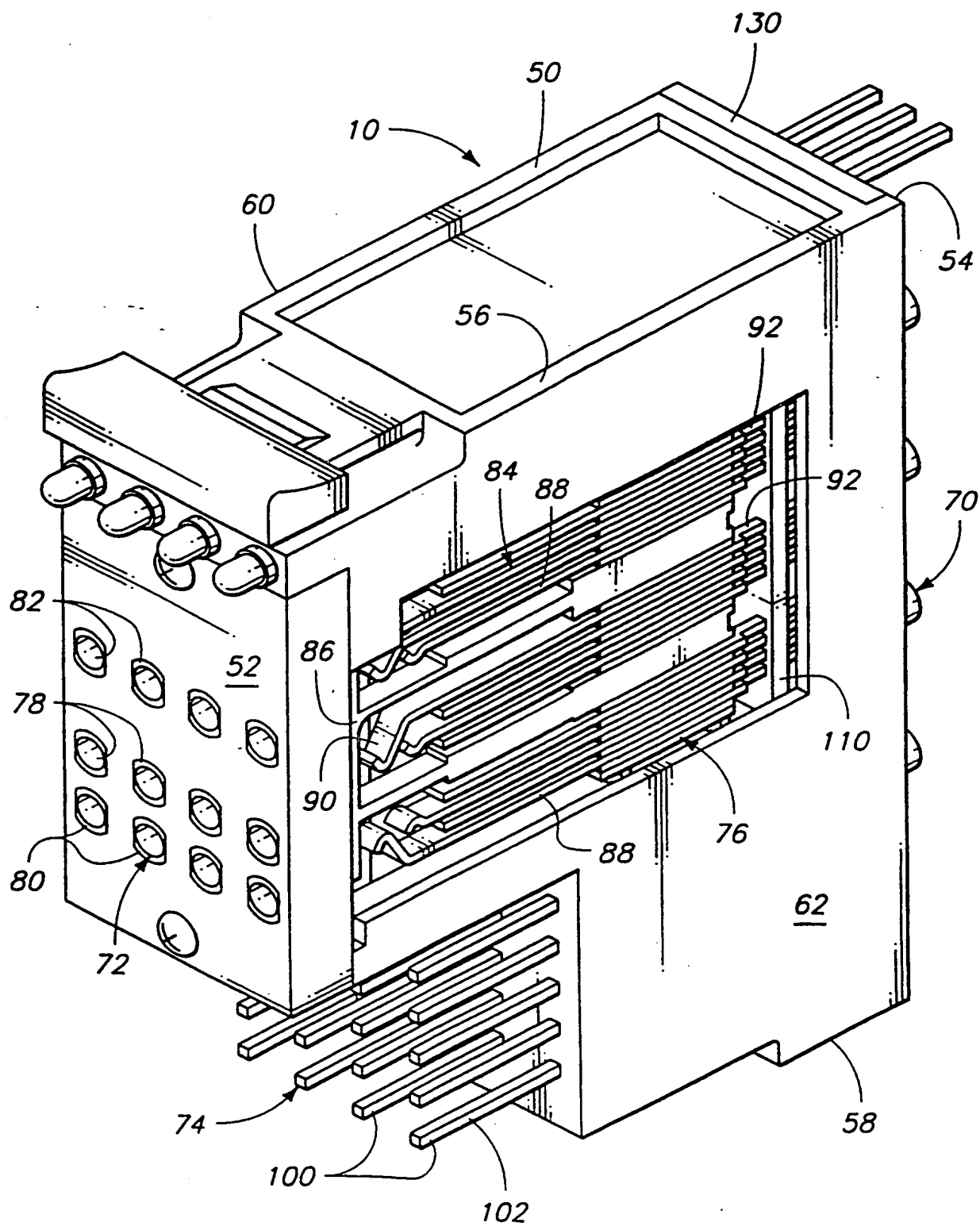
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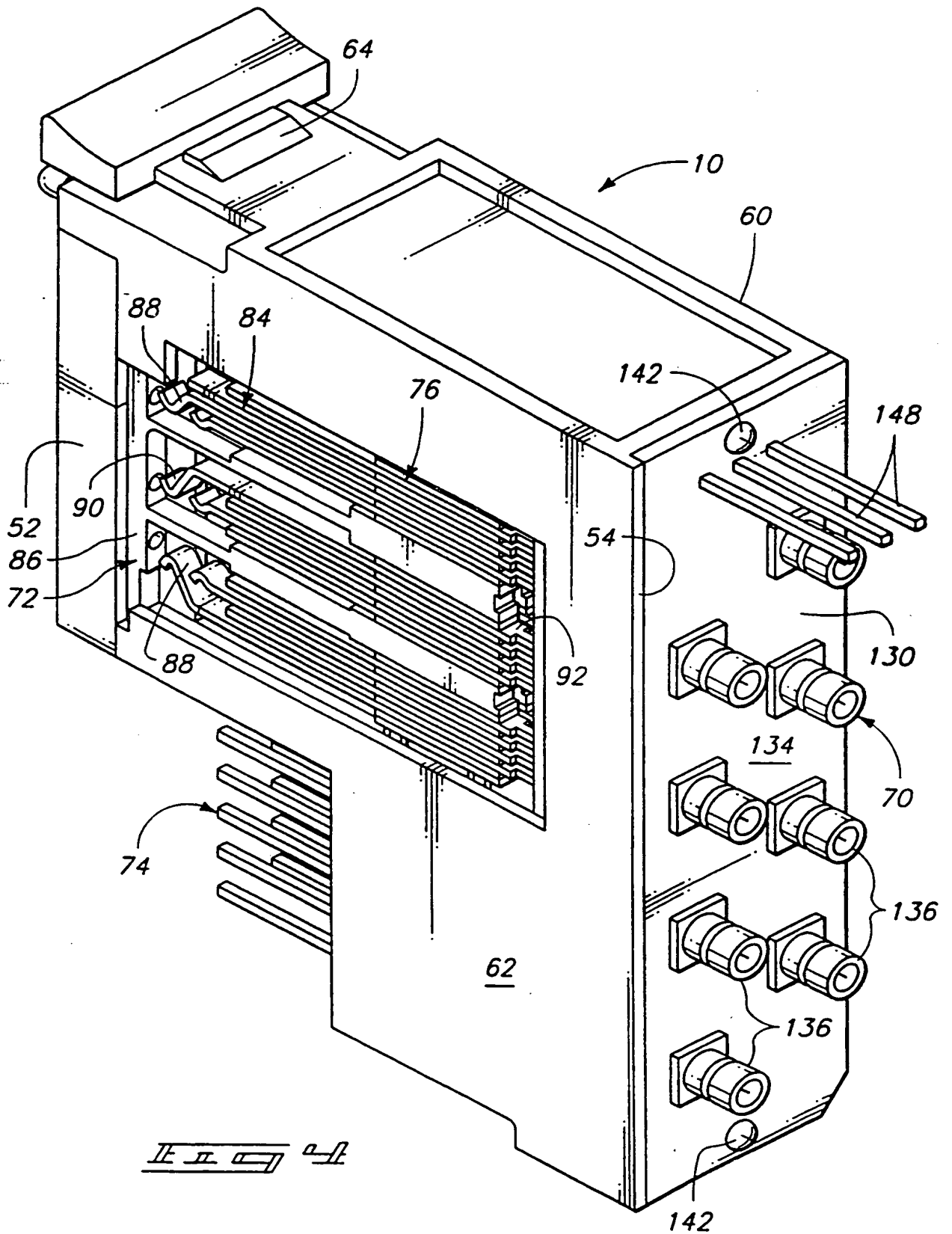
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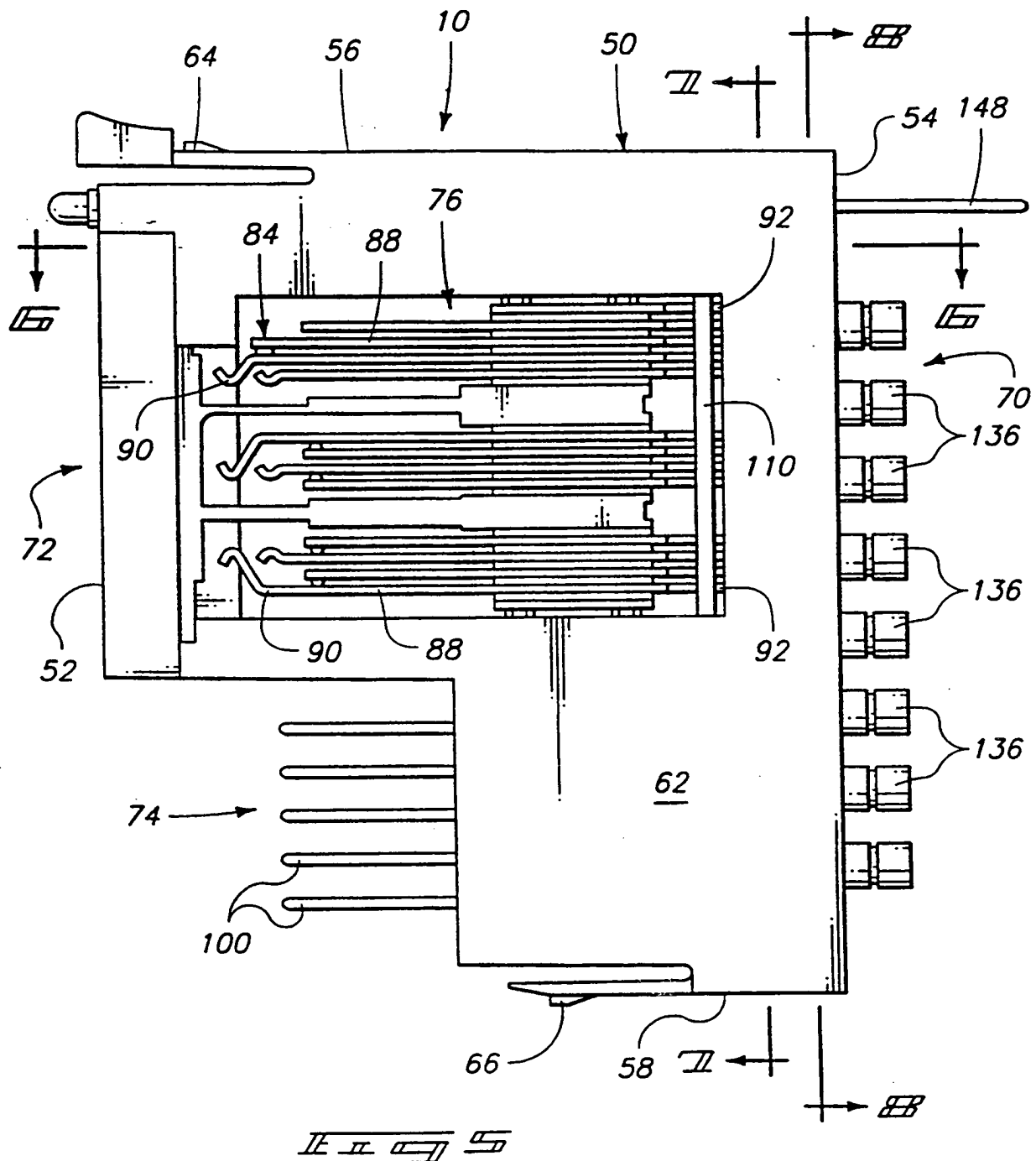


4/12





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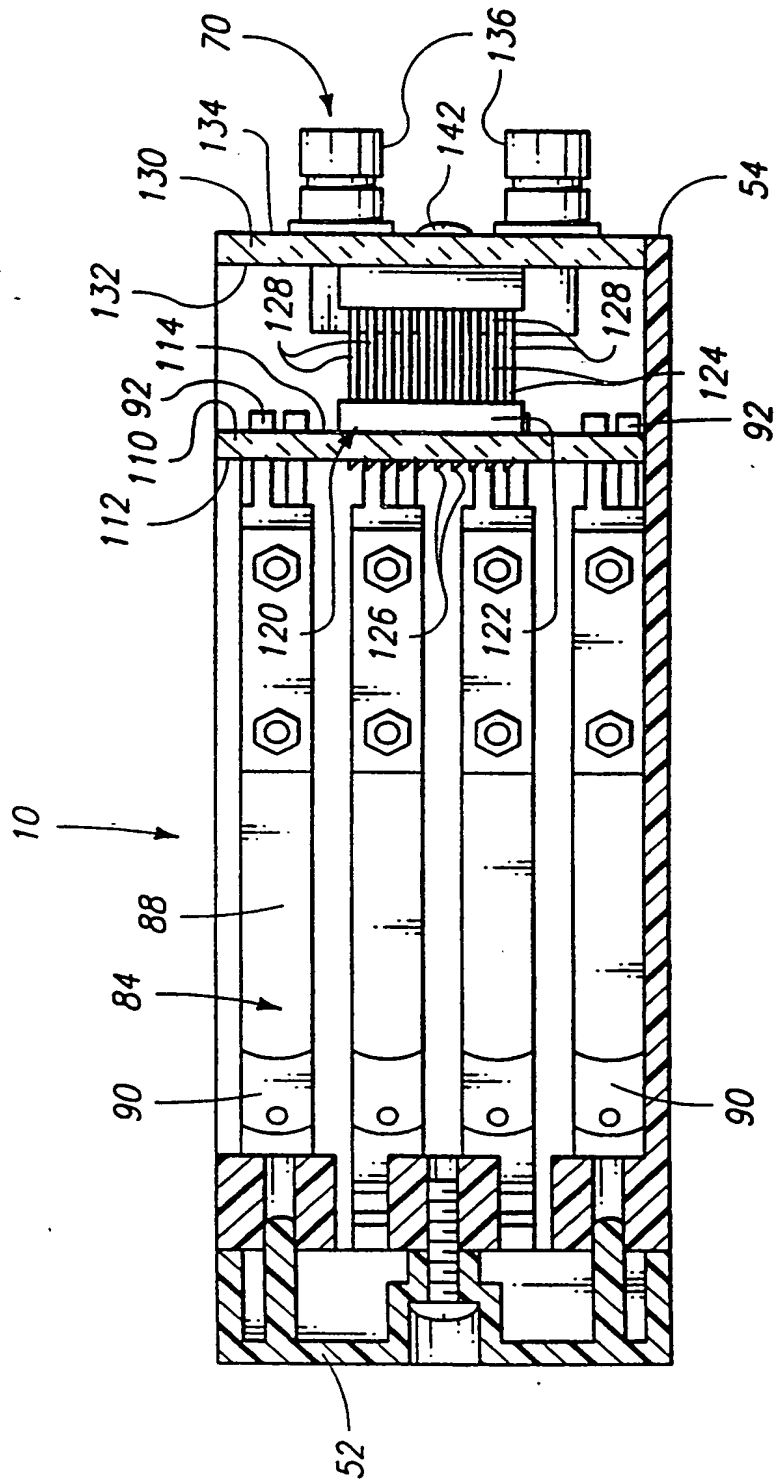
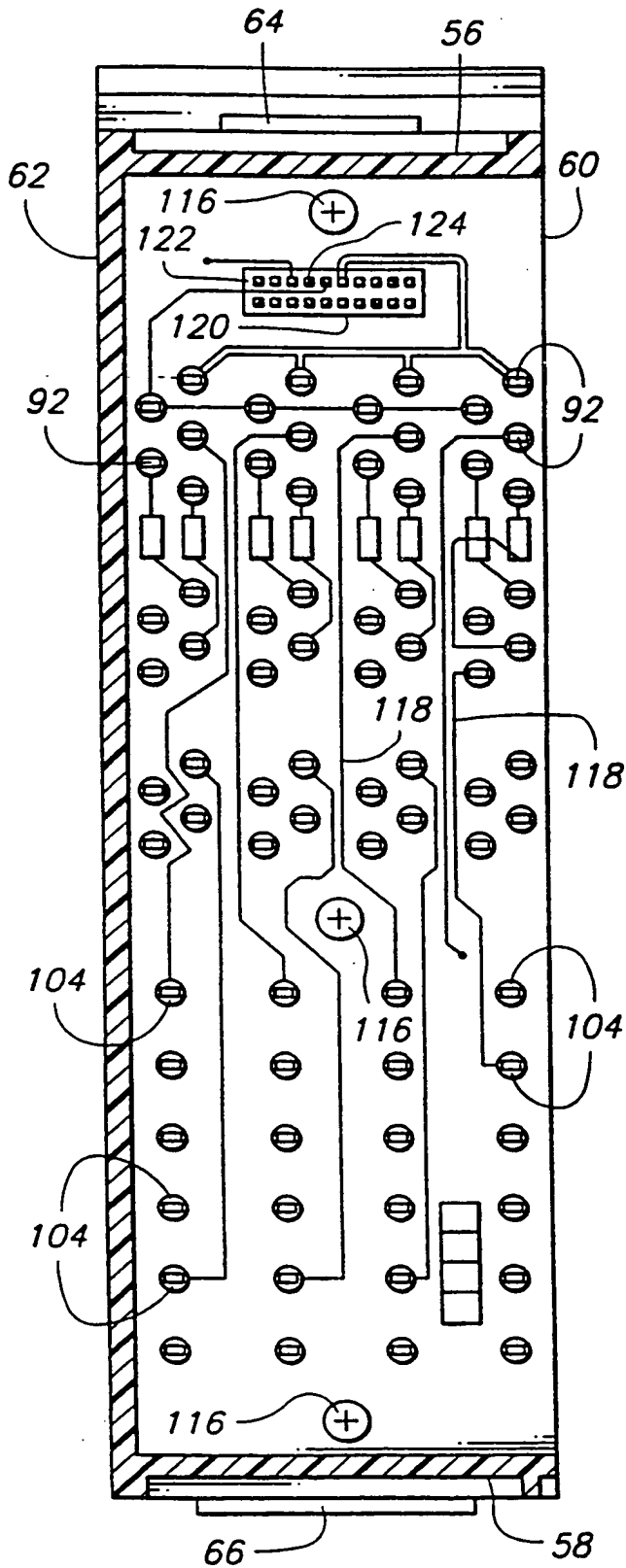
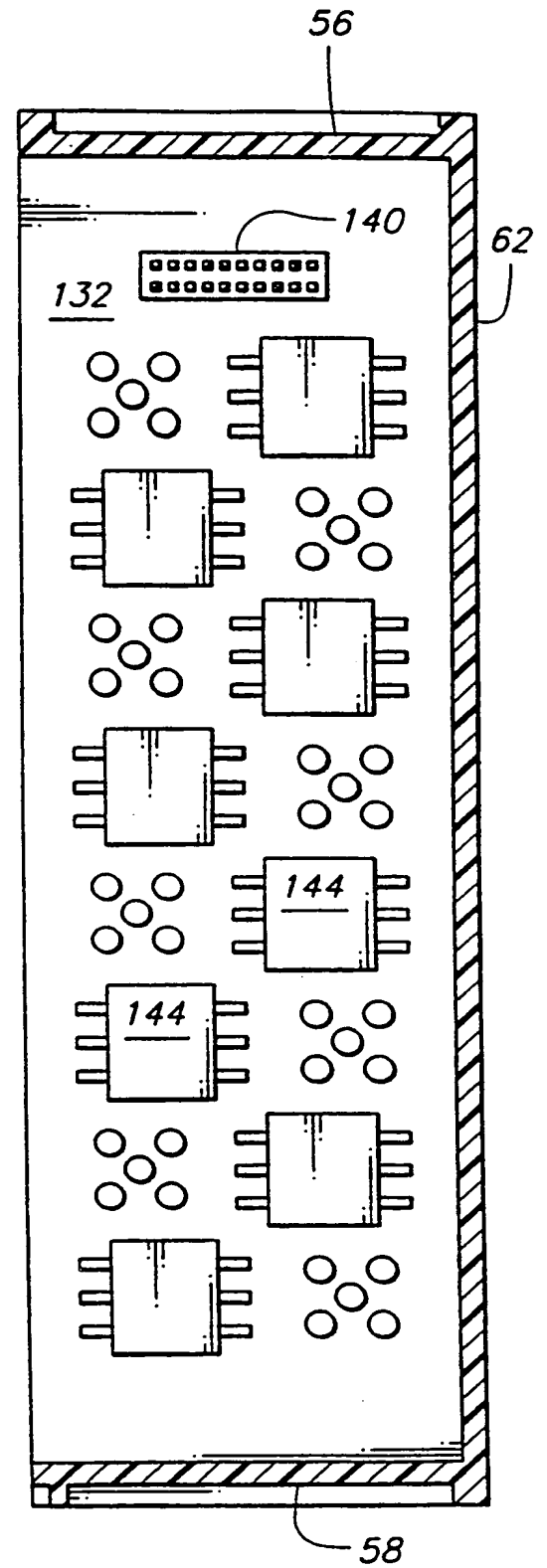
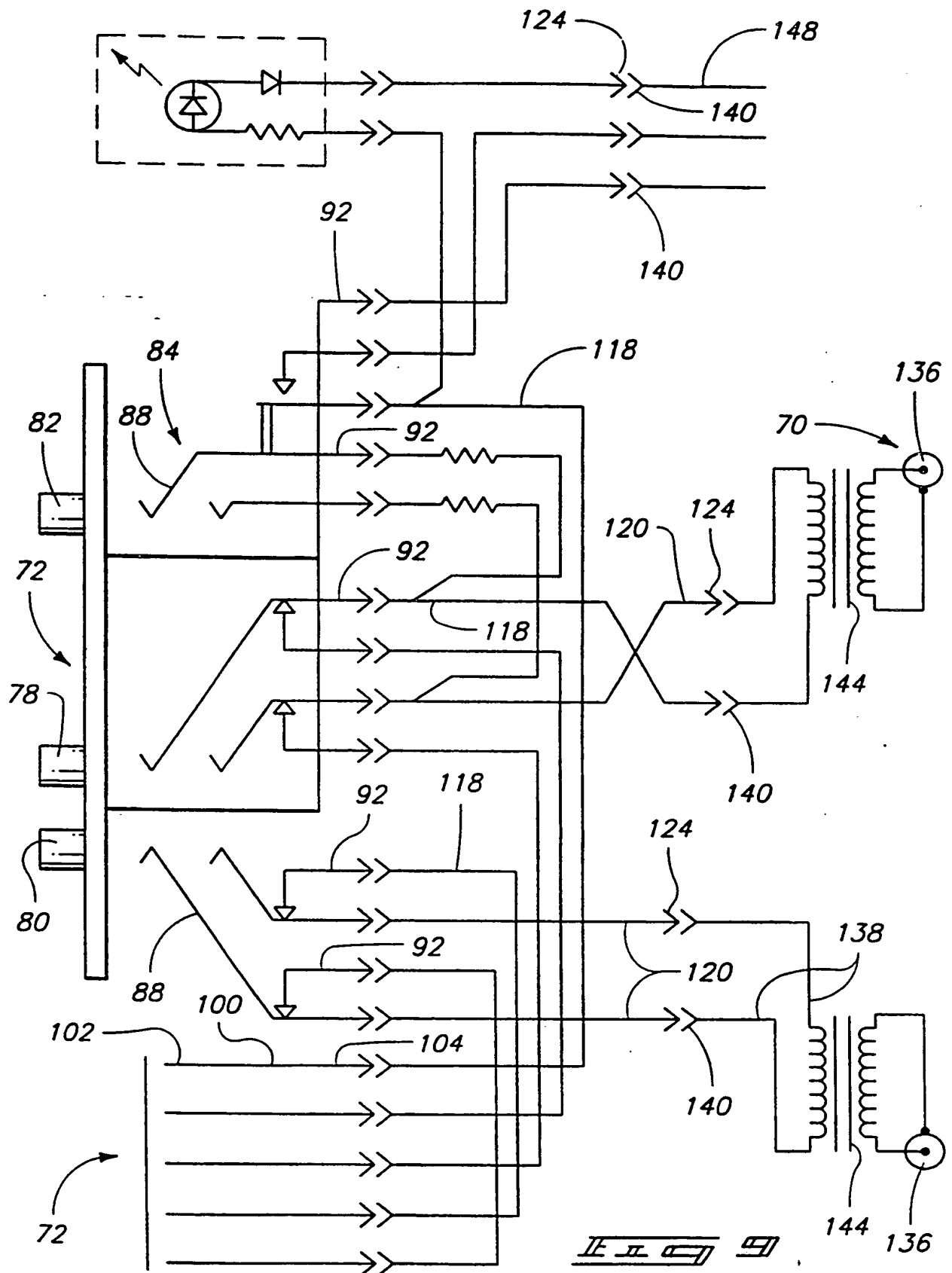


FIG. 6

7/12

FIG. 1FIG. 2

8/12



9/12

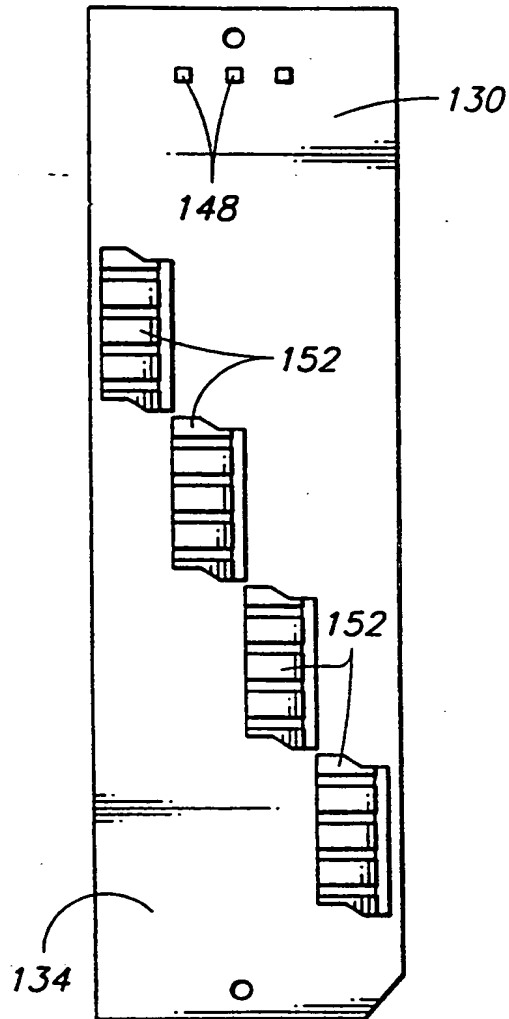


FIG. 10

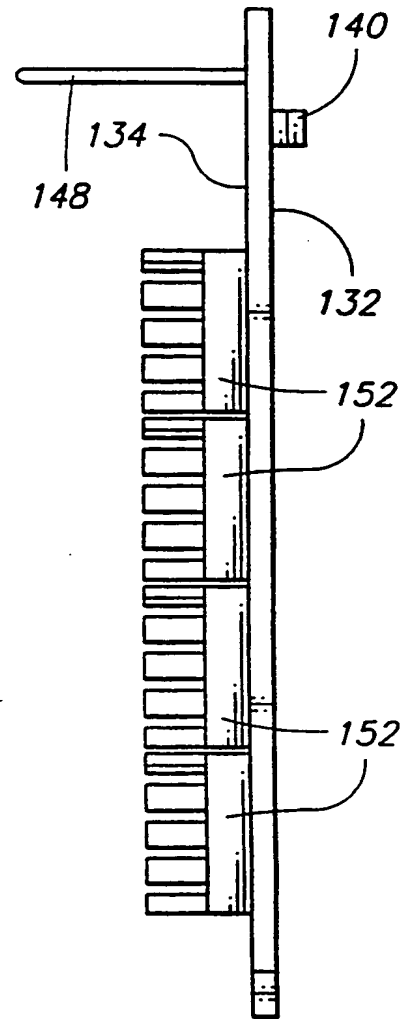
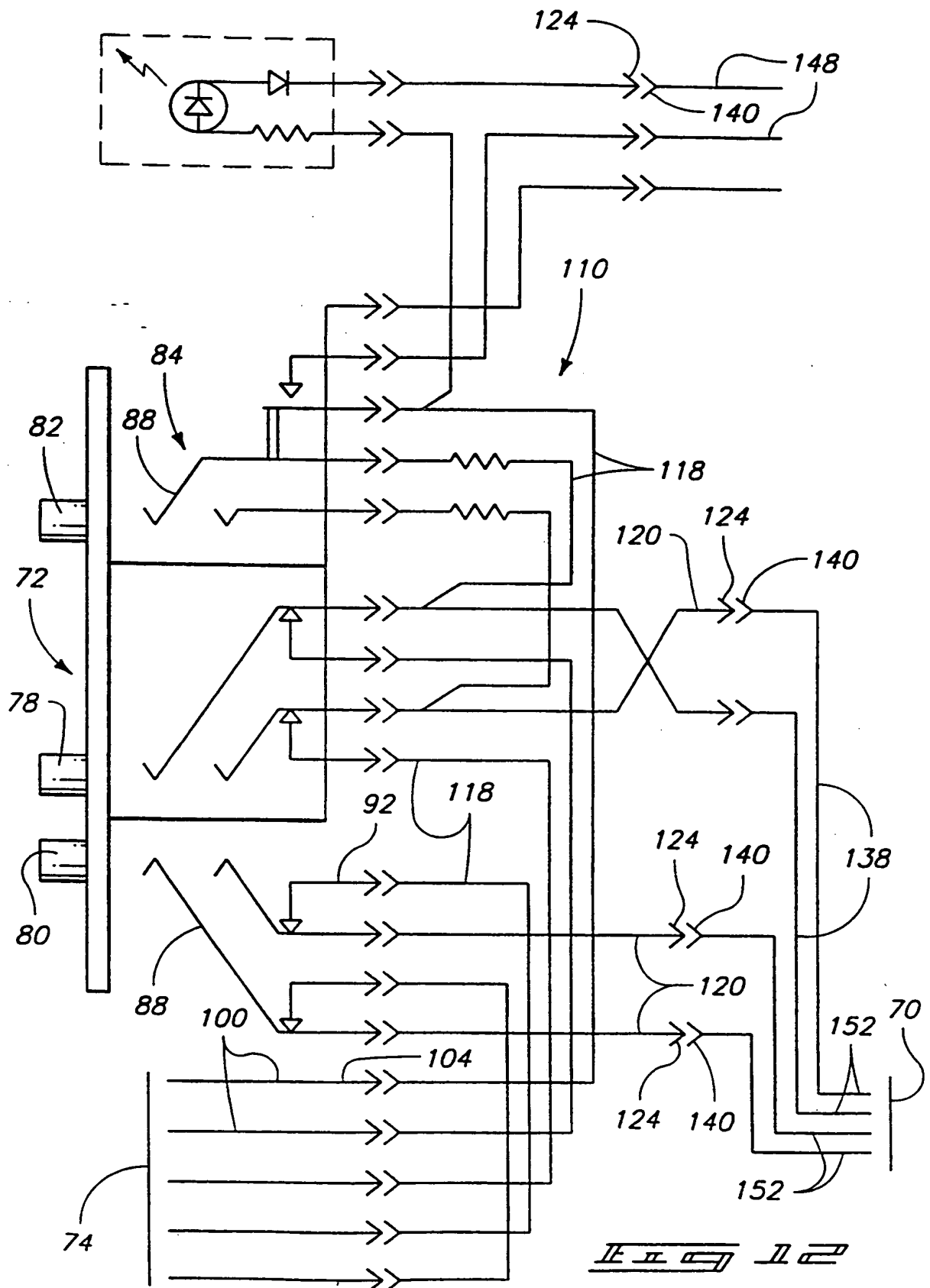


FIG. 11

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11/12

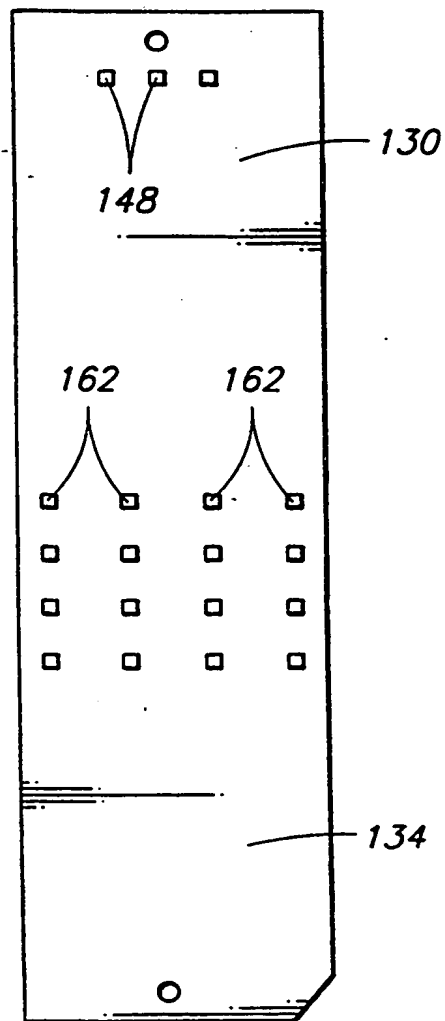


FIG. 11

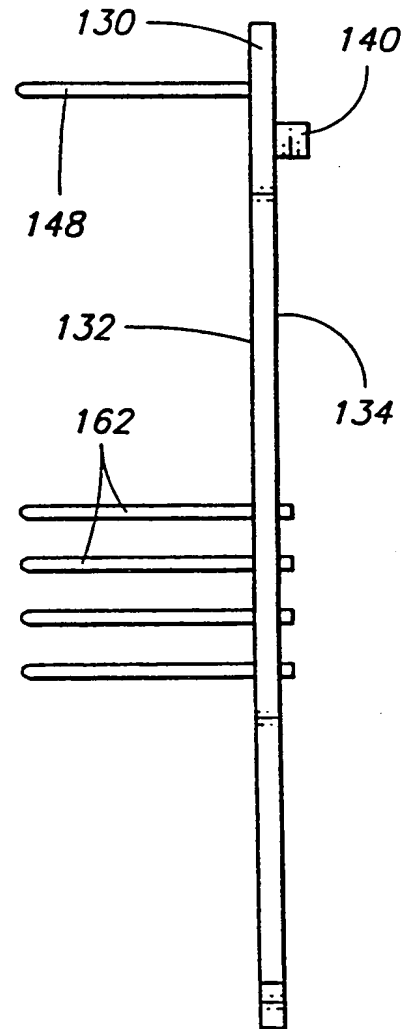


FIG. 12

12/12

